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ATTACHMENTS

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3.0 CRITICAL LIFTS

3.1 SCOPE

This chapter includes guidelines, rules, and requirements applicable to critical lifts and describes the planning and documentation required to perform a critical lift. This chapter also summarizes ordinary (noncritical) lifts for which special precautions are required. Section 3.9 contains nonmandatory worksheets provided as an aid to determining whether something is a critical lift and planning critical and special lifts.

3.2 CRITICAL LIFT DETERMINATION

The manager who has responsibility for the item to be lifted has the authority to require that it be handled as a critical lift. In addition, the manager at the facility where the lift will be performed also has the authority to require that it be handled as a critical lift. The manager who designates a lift as a critical lift shall ensure that a designated leader (DL) be assigned. (See Attachment 3-1, "Lift Determination Worksheet.")

3.3 GUIDELINES AND RULES FOR CRITICAL LIFTS

Guidelines provided here, characterized by the use of the word *should*, are recommendations, the applicability of which depends on the facts in each situation. Rules, characterized by the word *shall*, are mandatory. It is important to ensure that rigging; below-the-hook lifting devices; and cranes, hoists, and forklifts have current inspections and are never loaded beyond their rated capacity except for testing.

3.3.1 Guidelines

A lift shall be designated as a critical lift under any of the following circumstances.

1. If the item being lifted were to be damaged or upset, it could result in a release of radioactive or hazardous material into the environment which could exceed the established Permissible Environmental Limits (PEL). (Contact the Environmental organization for a determination of these levels.)
2. The item being lifted is unique and, if damaged, would be irreplaceable or not repairable and is vital to a system, facility, or project operation.
3. The cost to replace or repair the item being lifted, or the delay in operations of having the item damaged would have a negative impact on facility, organizational, or DOE budget to the extent that it would affect program commitments.
4. The item, although noncritical, is to be lifted above or in close proximity to a critical item or component.
5. The load being lifted is 95% or more of a mobile crane's chart rating for the maximum radius that will be experienced.
6. Two mobile cranes are lifting the load and the load share equals more than 70% of one or both crane's chart rating for the maximum radius that will be experienced.

   NOTE: A Critical lift designation provides:

   - Documented step-by-step instructions
   - Pre-identified load path
   - Sign-off approvals for technical, management, and safety or engineering.

- Documentation of lift and pre-job meeting.
- Independent pre-identification of load weight, load center of gravity, lift attachment points, and lifting hardware minimum capacities (slings, below-the-hook lifting devices, shackles, etc.) that will be used for the lift or series of lifts.
- Load testing of the lifting hardware (slings, below-the-hook lifting devices, shackles, etc.) that will be used for the lift.
- Evaluation of hazards associated with the lift that may include environmental, ground support, and physical obstructions
- Pre-identified special limiting or stop-work conditions.

3.4 CRITICAL LIFT EQUIPMENT AND HARDWARE

3.4.1 General

Before making a critical lift, the DL shall ensure that equipment (cranes, hoists, forklift trucks, etc.) inspections are current and that load tests have been done for slings, rigging, rigging hardware, and below-the-hook devices. (Exceptions apply to manufacturer-installed rigging hardware. See paragraph 3.4.1.1.)

3.4.1.1 Manufacturer-Installed Rigging Hardware on Engineered Equipment

Engineered equipment with manufacturer-installed rigging hardware (eyebolts, swivel hoist rings, etc.) should be purchased with load-test documentation supplied. Rigging hardware on engineered equipment, installed by the equipment manufacturer, without test documentation, may be used if approved by a rigging specialist or qualified engineer and inspected by a qualified inspector before use.

3.4.2 Rigging Hardware for Critical Lifts

The rigging hardware components (slings, shackles, chain, etc.) to be used in critical lifts shall be rated-capacity/load tested as specified in Section 3.4.3. Rigging components that have been load tested shall be marked or tagged by the user, a third party, or the manufacturer to verify the rated-capacity/load test. Documentation shall be traceable to the hardware. Traceability may be accomplished placing a tag or other permanent marking on the hardware. The manufacturer, the user, or a third party may perform load tests. Tags or other permanent marking fulfill documentation requirements without paperwork, except for below-the-hook lifting devices, which require additional documentation (see Chapter 11, “Below-the-Hook Lifting Devices”).

3.4.3 Rigging Hardware Rated-Capacity Testing for Critical Lifts

Each rigging hardware component is qualified in accordance with Section 3.4.2. Rigging hardware for critical lifts can include the following and shall meet the requirements found in the referenced chapter.

1. **Wire Rope Slings**, including the following:
   a. Swaged socket and poured socket assemblies
   b. Hand tucked
   c. Mechanical-splice, single-leg, and endless wire rope slings
   d. Multiple-leg bridal
   e. Master link to which multiple-leg slings are connected

   See Chapter 9, “Slings,” for wire rope sling rated load test requirements.

2. **Alloy Chain Slings**, including the following:
   a. Single- or multiple-leg slings, each leg.
   b. Master links and coupling links (forged or welded) for multiple-leg chain slings

   See Chapter 9, "Slings," for alloy chain slings rated load test requirements.
3. **Metal Mesh Slings**. See Chapter 9, "Slings," for metal mesh slings rated load test requirements.
4. **Synthetic Web Slings**. See Chapter 9, "Slings," for synthetic web slings rated load test requirements.
5. **Synthetic Rope Slings**. See Chapter 9, "Slings," for synthetic rope slings rated load test requirements.
6. **Shackles**. See Chapter 10, "Rigging Hardware," for shackles rated load test requirements.
7. **Eyebolts**. See Chapter 10, "Rigging Hardware," for eyebolts rated load test requirements.
8. **Rings (Forged and Welded)**. See Chapter 10, "Rigging Hardware," for rings rated load test requirements.
9. **Swivel Hoist Rings**. See Chapter 10, "Rigging Hardware," for swivel hoist rings rated load test requirements.
10. **Turnbuckles**. See Chapter 10, "Rigging Hardware," for turnbuckles rated load test requirements
11. **Below-the-Hook Lifting Devices** (in accordance with ASME B30.20). See Chapter 11, "Below-the-Hook Lifting Devices," for rated load test requirements and for requirements imposed by ANSI N14.6.
12. **Dynamometers and Precision Load-Position Devices (hydro-set)**. Load test at maximum capacity.

NOTE: The tolerance for load tests/proof tests is +0, -5%. If the hardware manufacturer recommends loads greater than those listed in the referenced chapter, the manufacturer's recommendations should be followed.

3.5 CRITICAL LIFT PLAN

A step-by-step plan or work instructions shall be prepared or approved by a technically qualified person. (See Attachment 3-9, "Plan Worksheet.") Critical lift plans shall contain the following:

NOTE: The items in the following list are required as designated by the key:
* Generally required, depending on situation and equipment used
** Required.

1. ** Identity of the item(s) to be lifted.
2. * Special precautions, if any (such as mats for mobile cranes)

3. ** Weight of the item and total weight of the load (For mobile cranes, see the manufacturer's instructions regarding components and attachments that must be considered as part of the load.)

4. * Location of the center of gravity

5. ** A list that specifies each piece of equipment (e.g., crane, hoist, fork truck), accessory, and rigging component (e.g., slings, shackles, spreader bars, yokes) to be used for the lift. (This list shall identify each piece of equipment by type and rated capacity.)

6. * Designated checkpoints or hold points and estimated instrument readings, as relevant, so that job progress can be checked against the plan

   NOTE: Sign-offs in the plan generally are appropriate. For example, initial and time/date the plan as key steps are completed. Hold points or sign-off points should be provided for personnel assigned to witness the work.

7. * Rigging sketch(s), which include the following:

   a. Lift point identification
   b. Method(s) of attachment
   c. Load angle factors (e.g., vertical and horizontal vectors of sling loads)
   d. Sling angles
   e. Accessories used
   f. Other factors affecting the equipment capacity
   g. Rated capacity of equipment in the configuration(s) in which it will be used. (For mobile cranes, many factors affect rated capacity, including boom length, boom angle, and work area.)

8. * A load-path sketch that shows the load path and height at key points in the job. (For lifts with mobile cranes, include the crane position(s) relative to the load and relative to surrounding obstructions. Where appropriate, include floor- or soil-loading diagrams.)

9. * A sketch indicating lifting and travel speed limitations. (This may be noted on the load-path sketch or on a separate sketch.)

10. ** A sign-off sheet to verify that equipment and hardware inspections and tests are current.

11. * Practice lifts are recommended. (If used, requirements for the practice lift should be documented in the plan.)

NOTE: Although individual plans are prepared for one-time critical lifts, more general (multi-use) plans may be employed to accomplish recurrent critical lifts. For example, a general plan may be used to lift an item or series of similar items that are handled repeatedly in the same manner.

3.5.1 Critical Lift Plan Approval

The critical lift plan or work instructions should be approved as required by the responsible contractor's processes and, as a minimum, shall be signed and dated by the following:

1. Technical approver (see Appendix A for definition)

2. Manager responsible for the item to be lifted
3. Qualified engineer
4. Qualified occupational safety representative.

3.5.2 Critical Lift Plan Field Revisions

Critical lift plan or work instruction field revisions shall be accomplished by drawing a single line through the original (deleted) text and inserting the field revision close to the deleted text. The field revision shall be initialed and dated by the person(s) making the revision. Text shall not be obliterated by the use of correction fluid, correction tape, scribbling, erasure, or any other method. Field revisions should be approved as required by the responsible contractor's plans. As a minimum, critical lift field revisions shall be signed and dated in the margin of each revised page by all of the following:

1. The manager of the lifting operation or facility manager
2. The DL
3. The qualified engineer
4. Qualified occupational safety representative

NOTE: Critical lift field revisions may be confirmed by telephone and must be signed and dated within two working days of the field revision.

3.6 PRELIFT AND FIELD REVISION REVIEW MEETINGS

Before performing a critical lift and immediately following a field revision, participating personnel shall meet to accomplish the following.

NOTE: The DL or facility-assigned person shall ensure that all members of the work team completely understand the work instructions or field revision.

1. Review the critical lift plan or field revision
2. Discuss any hazards, controls, hold points, coordination with other work groups, unique conditions, and emergency contingencies
3. Resolve questions before beginning work.

3.7 CRITICAL LIFT DOCUMENTATION AND RECORD RETENTION

As a minimum, documentation of each prelift and field revision meeting shall include an attendance roster showing the meeting time and date and a list of attendees. The DL or facility-assigned person shall retain meeting documentation until the lift is satisfactorily completed. When the job is finished, the DL or facility-assigned person shall transmit the critical lift documentation to the manager for whom the lift was done. This documentation is subject to audit for 1 year after the lift is completed.

Documentation of a critical lift shall include the following:

1. The critical lift plan, recording job completion with approval signatures and hold point sign-offs as applicable
2. Documentation of the pre-lift meeting; containing, as a minimum, the meeting date and list of attendees
3. Any additional documentation deemed appropriate by management.

NOTE: Documentation of the pre-lift meeting should be included as part of the critical lift plan.

NOTE: The special lift section provides elements of chapters in the manual that contain additional requirements when performing specific hoisting and rigging activities and allows elements of the critical lift requirements to be adopted at management's discretion to provide additional administrative and physical controls.

This section also provides for use of pre-engineered lifting that may include independent pre-identification of load weight, load center of gravity, lift attachment points, and minimum lifting hardware (slings, below-the-hook lifting devices, shackles, etc.) capacities that will be used for the lift or series of lifts of noncritical items.

3.8 SPECIAL LIFTS – NON-CRITICAL LIFTS THAT REQUIRE SPECIAL PRECAUTIONS

As addressed in other parts of this manual, certain lifting operations require special precautions. (See Attachment 3-2, "Special Lift Determination Worksheet.") Special precautions are required under the following conditions:

1. A mobile crane is working near power lines or transmission towers (see paragraph. 14.4.7).
2. Personnel are being lifted with cranes or forklifts. For mobile cranes, follow the requirements found in Chapter 15. For forklift trucks, follow the requirements found in Chapter 6, paragraph. 6.13.
3. Two or more cranes will be used to make a lift. (For hoists, jib cranes, and monorail systems, follow requirements found in Chapter 12, paragraph. 12.7, item 6. For overhead and gantry cranes, follow the requirements found in Chapter 13, paragraph. 13.6, item 8. For mobile cranes, follow the requirements found in Chapter 14, paragraph. 14.4.5.11).
4. **Pre-Engineered Lifts**. Independent pre-identification of load weight, load center of gravity, lift attachment points, and minimum lifting hardware capacities (slings, below-the-hook lifting devices, etc.) that will be used for the lift or series of lifts for noncritical items such as the following:
    - Large or unusually configured loads outside a fork truck's load center will be handled. Follow the requirements found in Chapter 6, paragraph. 6.12, item d.
    - Loads in close proximity to an existing building or operating equipment.
    - Nonroutine rigging configurations are being used or items require special care because of size, weight, close–tolerance installation, or high susceptibility to damage.

NOTE: The special lift section provides elements of chapters in the manual that contain additional requirements when performing specific hoisting and rigging activities and allows the adoption of elements of the critical lift requirements, at management's discretion, to provide additional administrative and physical controls. The special lift category provides for the use of pre-engineered lifting that may include independent pre-identification of load weight, load center of gravity, lift attachment points and minimum lifting hardware (slings, below-the-hook lifting devices, shackles, spacers, softeners, etc.) capacities that will be used for the lift or series of lifts of noncritical items.

3.9 WORKSHEETS

Worksheets are provided as an aid and are not required documents. A qualified engineer, occupational safety representative, DL, or rigging specialist may determine that additional elements need to be considered. The following sample worksheets are provided as attachment.

- Attachment 3-1 - Lift Determination Worksheet
- Attachment 3-2 - Special Lift Determination Worksheet
- Attachment 3-3 - Load Worksheet
- Attachment 3-4 - Rigging Hardware Worksheet
- Attachment 3-5 - Rigging Hardware Worksheet

- Attachment 3-6 - Crane Worksheet
- Attachment 3-7 - Forklift Worksheet
- Attachment 3-8 - Personnel Worksheet
- Attachment 3-9 - Plan Worksheet.

ATTACHMENT 3-1 - LIFT DETERMINATION WORKSHEET

Lift Description: _____

Load Category		
Yes	**No**	
		Damage would result in a release of radioactive or hazardous material exceeding established Permissible Environmental Limits
		The item, if damaged would be irreplaceable or not repairable and is vital to a system, facility, or project operation
		The cost to replace or repair the item, or delay in operations of having the item damaged would have a negative impact on facility, organizational, or DOE budget to the extent that it would affect program commitments
		The item, although noncritical, is to be lifted above or in close proximity to a critical item.
		Load is 95% or more of mobile crane's capacity chart rating for the maximum that will be experienced.
		Two cranes will be used and the load share equals more than 70% of one or both crane's chart rating for the maximum radius that will be experienced

The manager who has responsibility for this lift should consider the lift for critical-lift status when a **yes** response is recorded.

Critical Lift **Yes** ☐ **No** ☐

Reviewer _____ Date _____

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ATTACHMENT 3-2 - SPECIAL LIFT DETERMINATION WORKSHEET

Lift Description: _____

Load Category		
Yes	**No**	
		A mobile crane is working near power lines or transmission towers. Follow the requirements found in Chapter 14, Section 14.4.7, "Operating Cranes Near Energized Transmitters or Electric Power Lines."
		Lifting personnel with mobile cranes. Follow the requirements found in Chapter 15, "Personnel Lifting."
		Lifting personnel with forklifts. Follow the requirements found in Chapter 6, "Forklift Trucks, Section 6.13, "Lifting of Personnel."
		Two or more cranes will be used to make a lift. For hoists, jib cranes, and monorail systems, follow the requirements found in Chapter 12, "Hoists, Jib Cranes, and Monorail Systems, Section 12.7, "Moving the Load," item 6. For overhead and gantry cranes, follow the requirements found in Chapter 13, "Overhead and Gantry Cranes," Section 13.6, Moving the Load," item 8. For mobile cranes, follow the requirements found in Chapter 14, "Mobile Cranes," Section 14.4.5, "Moving the Load," item 11.
		Handling large or unusually configured loads outside a forklift truck's load center. Follow the requirements found in Chapter 6, "Forklift Trucks," Section 6.12, "Conduct of the Operator," item d.
		Working in close proximity to an existing building or operating equipment. Consider drawings, validating clearances with site analysis, identifying limitations and hazards with review in pre-job meeting.
		Use of nonroutine rigging configurations. Consider drawings identifying attachment points, validating load weight, validating capacities, calculation of slings/lifting devices and rigging hardware loading, analysis identifying limitations and hazards with review in pre-job meeting.

The manager who has responsibility for this lift should consider the lift for special-lift status based on safety of personnel or equipment when a **yes** response is recorded.

Special lift **Yes** ☐ **No** ☐

Reviewer _____ Date _____

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ATTACHMENT 3-3 - LOAD WORKSHEET

Lift Description: _____

Applicable Check only those items that are applicable to this lift.

Yes	No	
		Load weight was calculated and calculations used to determine weight were validated or the source documents were verified.
		Weight of all items to be lifted with load and rigging have been included in total lift weight.
		Load center of gravity has been determined.
		Attachment points have been identified.
		Attachment points have been inspected for defects.
		Attachment point share of load has been calculated.

Items checked with yes are applicable to this lift and should be identified in the lift plan.

Reviewer _____ Date _____
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ATTACHMENT 3-4 - RIGGING HARDWARE WORKSHEET

Lift Description: _____

Applicable Check only those items that are applicable to this lift.

Yes	No	
		Wire rope Slings are in good condition, have traceable documentation or tagging with current inspection and load test date and sling is marked by manufacturer with name and rated capacity
		Synthetic slings are in good condition, have traceable documentation or tagging with current inspection and load test date and marked by manufacturer with name or trademark, manufacturer code or stock number, type of synthetic material and rated capacity for types of hitches.
		Alloy Steel Chain Slings are in good condition, have traceable documentation or tagging with current inspection and load test date and sling is marked by manufacturer with name or trademark, manufacturer's grade, chain size, reach, rated capacity and angle upon which rating is based and number of legs.
		Metal mesh slings are in good condition, have traceable documentation or tagging with current inspection and load test date and sling is marked by manufacturer with name or trademark, rated capacity for types of hitches.
		Shackles are in good condition have tagging with load test date and shackle is marked with manufacturer name or trademark, size and safe working load or working load limit marked on the shackle bow.
		Eye bolts are in good condition, is properly installed, has traceable documentation or tagging with load test date and is marked by manufacturer with name or trademark, (marked with an" A" is alloy).
		Swivel Hoist rings are in good condition is installed per manufacturer instructions has traceable documentation or tagging with load test date and marked by manufacturer with name or trademark, Safe working load or working load limit, and torque value
		Weld less rings are in good condition, have tagging with load test date.

Items checked with yes are applicable to this lift and should be identified in the lift plan.

Reviewer _____ Date _____

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ATTACHMENT 3-5 - RIGGING HARDWARE WORKSHEET

Lift Description: _____

Applicable Check only those items that are applicable to this lift.

Yes	No	
		Welded rings are in good condition; have tagging with load test date, traceable documentation that ring was designed by qualified engineer, and have been subjected to weld nondestructive testing.
		Turnbuckles are in good condition; were approved by a qualified engineer or rigging specialist; have tagging with inspection due date, load test date, manufacturer's name, and rated capacity or capacity.
		Below the hook lifting devices are in good condition; have traceable documentation or tagging with current inspection and load test date; and are marked by manufacturer with name or trademark, rated capacity weight if over 100 lb, drawing number, and serial number when applicable.
		Dynamometers and precision load position devices have traceable documentation or tagging with load test date and are marked by manufacturer with name or trademark and rated capacity.
		Permanently installed rigging hardware on engineered equipment installed by manufacturer without load test documentation is approved for use by rigging specialist and inspected by qualified inspector before use
		Taglines will be needed for load positioning.

Items checked with yes are applicable to this lift and should be identified in the lift plan.

Reviewer _____ Date _____

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ATTACHMENT 3-6 - CRANE WORKSHEET

Lift Description: _____

Applicable Check only those items that are applicable to this lift.

Yes	No	
		Crane monthly, annual, and pre-use inspections are current and crane is in good working condition.
		Crane net capacity, as configured, is greater than or equal to total intended gross load at maximum radius that will be experienced for mobile cranes.
		Crane or hoist has a load-limiting device (optional).
		Crane has a load-indicating device or load moment indicator (optional).
		Crane or hoist intended travel path and or swing radius is clear of obstructions.
		Crane or hoist hook is capable of holding the intended rigging.
		Sufficient headroom between the lower block and upper drum, point sheaves, or anti-two block device exists at all lift points considering rigging, load, and load block.
		More than one crane or hoist will support the load and intended share of load for each has been calculated.
		Mobile crane position has been identified and ground stability and loading has been evaluated and restrictions identified.
		Environmental restrictions and limitations that can affect the lift (radiological, biological, weather, etc.) have been considered and identified.

Items checked with yes are applicable to this lift and should be identified in the lift plan.

Reviewer _____ Date _____

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ATTACHMENT 3-7 - FORKLIFT WORKSHEET

Lift Description: _____

Applicable Check only those items that are applicable to this lift.

Yes	No	
		Forklift inspections are current, lift is in good working condition, and pre-use inspection is performed.
		Forklift capacity, with attachments as configured, is greater than or equal to total intended load.
		Forklift's load center and load center of gravity of load have been evaluated and calculations were performed to confirm forklifts capacity will not be exceeded.
		Manufacturer has approved forklift attachments for use with the specific lift and capacity if forklift and attachment capacity is greater than intended load.
		Forklifts intended travel path is clear of obstructions, and ramps or grades have been taken into consideration.
		Sufficient headroom between mast or load and overhead obstructions exists.
		Ground stability and or floor loading have been evaluated.

Items checked with yes are applicable to this lift and should be identified in the lift plan.

Reviewer _____ Date _____

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ATTACHMENT 3-8 - PERSONNEL WORKSHEET

Lift Description: _____

Applicable Check only those items that are applicable to this lift.

Yes	No	
		Qualified designated leader has been assigned and identified (the facility may assign this responsibility to a qualified facility-assigned)
		Qualified crane operator has been assigned.
		Qualified riggers have been assigned.
		Additional support personnel have been identified and assigned.
		A qualified signaler has been assigned for mobile crane working within extendable boom length of power lines to prevent contact with power lines.
		Qualified signaler has been assigned to flag crane operations.
		Qualified forklift operator has been assigned.

Items checked with yes are applicable to this lift and should be identified in the lift plan.

Reviewer _____ Date _____

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ATTACHMENT 3-9 - PLAN WORKSHEET

Lift Description: _____

Applicable Check only those items that are applicable to this lift.

Yes	No	
		Identifies and addresses those items checked with **yes** in these worksheets.
		Drawings, sketches, and analysis.
		Material and equipment list.
		Safety assessment.
		Restrictions and limitations.
		Required approvals and signatures.
		Hold or check points.
		Special precautions.
		Stop work conditions such as wind speed or other environmental conditions.
		Pre-lift meeting with list of attendees.
		Pre-lift meeting when revisions are made with list of attendees.

Items checked with yes are applicable to this lift and should be identified in the lift plan.

Reviewer _____ Date _____

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